Claims

1. A mold assembly for generating a composite part from a strengthener in a generally solid phase and a matrix in a generally liquid phase; said mold assembly comprising:

   a) a base mold including a strengthener chamber for receiving the strengthener and a matrix injection inlet for injecting the matrix in said strengthener chamber;

   b) a cover mold including a compression chamber and a fluid control aperture for injecting a fluid in said compression chamber; said cover mold being so configured as to be sealingly mounted on said base mold whereby said strengthener chamber and said compression chamber are adjacent; and

   c) a deformable member so provided in a gap defined by said strengthener chamber and said compression chamber as to pressurize the matrix toward the strengthener upon compression by the fluid.

2. A mold assembly as recited in claim 1, wherein said matrix injection inlet includes a diffusion passage provided on a contact wall of said strengthener chamber.

3. A mold assembly as recited in claim 1, wherein said base mold includes an evacuation outlet.

4. A mold assembly as recited in claim 3, wherein said evacuation outlet is connectable to a vacuum source to selectively generate at least a partial

vacuum in said strengthener chamber.

5. A mold assembly as recited in claim 1, wherein base mold includes a contact wall, peripheral walls extending around said contact wall and shoulders extending around said peripheral walls; said cover mold includes a compression wall, peripheral walls extending around said compression wall and shoulders extending around said peripheral walls, said cover mold being sealingly mounted to said base mold through a complementary ridge and groove arrangement provided along said shoulders of said base mold and said cover mold.

6. A mold assembly as recited in claim 5, wherein said ridge and groove arrangement has a generally triangular cross-sectional profile.

7. A mold assembly as recited in claim 1, wherein said fluid control aperture is connectable to a fluid source to generate pressure in said strengthener chamber.

8. A mold assembly as recited in claim 1, wherein said fluid control aperture extends in said cover mold and said matrix injection inlet extends in said base mold in a generally similar direction.

9. A mold assembly as recited in claim 1, wherein said cover mold includes a vent extending from said compression chamber and through said cover mold.

10. A mold assembly as recited in claim 9, wherein said vent is connected to a

vacuum source to selectively generate at least a partial vacuum in said compression chamber.

11. A mold assembly as recited in claim 9, wherein said vent comprises a valve to regulate the flow of the fluid through said vent.

12. A mold assembly as recited in claim 1, wherein said gap has a variable thickness.

13. A mold assembly as recited in claim 12, wherein said compression chamber has a first thickness, said strengthener chamber has a second thickness, said first and second thickness being variable upon deformation of said deformable member.

14. A mold assembly as recited in claim 1, wherein said deformable member includes a membrane sealingly mounted between said strengthener chamber and said compression chamber.

15. A mold assembly as recited in claim 14, wherein said membrane is impermeable to liquid.

16. A mold assembly as recited in claim 14, wherein said membrane is permeable to gas.

17. A mold assembly as recited in claim 1, wherein said mold assembly includes a means for inducing vibrations to the fluid injected in said mold

assembly to expel residual gases entrapped in the strengthener.

18. A mold assembly as recited in claim 1, wherein said mold assembly includes temperature controlling means.

19. A mold assembly as recited in claim 1, said strengthener chamber comprises a contact wall for locating the strengthener, said contact wall having a controlled surface finish.

20. A mold assembly as recited in claim 1, wherein said base mold and said cover mold are rigid.

21. A mold assembly as recited in claim 1, wherein said deformable member includes a deformable element and a membrane, said membrane being sealingly mounted between said strengthener chamber and said compression chamber, said deformable element being provided in at least a portion of said compression chamber.

22. A mold assembly as recited in claim 21, wherein a surface of said deformable element is so machined as to be complementary to the shape of the composite part.

23. A mold assembly as recited in claim 22, wherein said machined surface of said member includes a series of grooved channels so configured as to receive said membrane.

24. A mold assembly as recited in claim 21, wherein said deformable element is injected directly into said gap via said fluid control aperture.

25. A mold assembly as recited in claim 21, wherein said deformable element includes a generally porous and elastic material.

26. A mold assembly as recited in claim 1, wherein said deformable member includes an elastic material being provided in at least a portion of said compression chamber and adjacent to said strengthener chamber.

27. A mold assembly as recited in claim 1, wherein said cover mold includes compartmentalized portions so configured as to independently move with respect to one another toward and away from said strengthener chamber for providing a gap of variable thickness.

28. A mold assembly as recited in claim 1, wherein said mold assembly further includes a tube provided in said compression chamber and adjacent to said strengthener chamber, said tube being connected to a pressure source and deformable under pressure generated from the pressure source, said tube including at least one extremity mounted through said cover mold for controlling the pressure in said tube.

29. A mold assembly as recited in claim 1, wherein said cover mold includes a compression wall including a plurality of passages provided adjacent to said deformable member.

30. A mold assembly as recited in claim 29, wherein said plurality of passages

includes longitudinal passages and transversal passages configured in a grid so as to cooperate with said deformable member.

31. A mold assembly as recited in claim 29, wherein said matrix injection inlet of said base mold includes a diffusion passage extending on a contact wall of said strengthener chamber; said diffusion passage being generally aligned with at least one transversal passage and said matrix injection inlet of said base mold being generally aligned with at least one longitudinal passage.

32. A mold assembly for generating a predetermined number of composite parts from strengtheners in a generally solid phase and from matrix in a generally liquid phase; said mold assembly comprising:

a) a base mold including a strengthener chamber;

b) a cover mold including a compression chamber;

c) at least one frame assembly, each including a separator defining a further respective strengthener chamber and a further respective compression chamber; said at least one frame assembly being so configured as to be sealingly stacked one next to the other and between said base mold and said cover mold, whereby each of said strengthener chamber faces one of said compression chamber to define adjacent pairs of chambers;

d) matrix injection inlets for injecting the matrix in said strengthener chambers;

e) fluid control apertures for injecting a fluid in said compression chambers; and

f) deformable members so provided between said adjacent pairs of

chambers as to pressurize the matrix toward the strengthener upon compression by the fluid.

33. A mold assembly as recited in claim 32, wherein each of said deformable members is a membrane sealingly mounted between said adjacent pairs of strengthener chamber and compression chamber.

34. A mold assembly as recited in claim 32, wherein said mold assembly further includes evacuation outlets and vents, said evacuation outlets extending from said strengthener chambers and through said mold assembly; said vents extending from said compression chambers and through said mold assembly.

35. A mold assembly as recited in claim 32, wherein said cover mold is one of said at least one frame assembly.

36. A mold assembly as recited in claim 32, wherein said cover mold is one of said at least one frame assembly including a cover reinforcement so configured as to be rigidly mounted in its respective strengthener chamber.

37. A mold assembly as recited in claim 32, wherein said separator is rigid.

38. A mold assembly for generating a predetermined number of composite parts from strengtheners and matrix; said mold assembly comprising:

a) a base mold including a contact wall;

b) at least one frame assembly so configured as to be sealingly stacked

one next to the other on said base mold defining a stacking chamber thereby;

c) matrix injection inlets for injecting the matrix in the strengtheners trough said base mold and said at least one frame assembly;

d) deformable elements, each having a respective compression wall and a further respective contact wall, said deformable elements being so configured as to be alternatively stacked with the strengtheners in said stacking chamber whereby each of said contact wall faces one of said compression wall; and

e) a cover mold including a further respective compression wall and being mounted in said stacking chamber.

39. A mold assembly as recited in claim 38, wherein each of said deformable elements is porous elastic material.

40. A mold assembly as recited in claim 39, wherein each of said at least one frame assembly includes a fluid control aperture for injecting a fluid in said stacking chamber to said deformable elements.

41. A mold assembly as recited in claim 38, wherein each of said at least one frame assembly and said base mold are sealingly stacked in adjacent pairs and said mold assembly further includes membranes sealingly mounted between said adjacent pairs.

42. A mold assembly as recited in claim 41, wherein each of said at least one frame assembly includes a fluid control aperture extending for injecting a fluid between each of said deformable elements and each of said

membranes in said stacking chamber.

43. A mold assembly as recited in claim 1, wherein said mold assembly includes a porous medium provided in said compression chamber for controlling the propagation of the fluid injected in said compression chamber.

44. A mold assembly as recited in claim 1, wherein said porous medium is made from a generally deformable element.

45. A mold assembly for generating a composite part from a strengthener and a matrix; said mold assembly comprising:

a) a base mold including a strengthener chamber for receiving the strengthener and a matrix injection inlet for injecting the matrix in said strengthener chamber;

b) a cover mold including a compression chamber and a fluid control aperture for injecting a fluid in said compression chamber; said cover mold being so configured as to be sealingly mounted on said base mold whereby said strengthener chamber and said compression chamber are adjacent; and

c) a deformable membrane provided in a gap defined by said strengthener chamber and said compression chamber;

whereby upon operation, the matrix is injected via said injection inlet in the strengthener located in said strengthener chamber, a first portion of the matrix impregnates the strengthener and a second portion of the matrix remains in the strengthener chamber and deforms the deformable membrane thereby, said second portion being forced into the

strengthener by the fluid pressurizing said deformable membrane when injected in said compression chamber via said control aperture.

46. A method for generating a composite part from a strengthener and a matrix comprising:

a) sealingly positioning a deformable member in between a first chamber of a first mold portion and a second chamber of a second mold portion; said first chamber receiving the strengthener;

b) impregnating the strengthener with the matrix injected in said first chamber;

c) compacting the matrix toward the strengthener by pressurizing a controlling fluid injected in said second chamber on said deformable member.

47. A method as recited in claim 46, wherein said impregnating the strengthener is performed at a vacuum pressure which is lower than atmospheric pressure.

48. A method as recited in claim 46, wherein said compacting the matrix toward the strengthener is performed while heating said controlling fluid.

49. A method as recited in claim 46, wherein said compacting the matrix toward the strengthener is performed at a compaction pressure greater than atmospheric pressure.

50. A method as recited in claim 46, further including vibrating the impregnated strengthener to expel a significant portion of residual gases entrapped in

the strengthener.

51. A method as recited in claim 46, further including a solidification of the composite part at a compaction pressure greater than atmospheric pressure.

52. A method as recited in claim 46, further including a cure of the strengthener with heat transfer applied to said mold and the solidification of the composite part at a compaction pressure greater than atmospheric pressure.

53. A method as recited in claim 52, wherein said cure of the strengthener uses ultra-violet light.

54. A method as recited in claim 51, wherein said solidification of the composite part is performed while decreasing the temperature of the strengthener.

55. A method as recited in claim 46, further including a positioning of a deformable element in a second chamber of a second mold portion adjacent to said deformable member.

56. A method as recited in claim 46, further including a positioning of a tube in a second chamber of a second mold portion adjacent to said deformable member.

57. A method as recited in claim 56, wherein said compacting the matrix

toward the strengthener by pressurizing a controlling fluid is performed while pressurizing said tube whereby said tube deforms and compresses said member by compressing said controlling fluid.

58. A method as recited in claim 56, wherein said compacting the matrix toward the strengthener by pressurizing a controlling fluid is performed while pressurizing said tube whereby said tube deforms and compresses said member.

59. A method as recited in claim 46, wherein said compacting the matrix toward the strengthener by pressurizing a controlling fluid is performed while varying the position of compartmentalized portions of said second mold portion with respect to said member.

60. A method as recited in claim 46, further including a deformation of said member mating with passages in said second mold portion provided adjacent to said member.

61. A method as recited in claim 46, further including a positioning of a porous medium in a second chamber of a second mold portion adjacent to said deformable member.

62. A method for generating a pre-determined number of composite parts from strengtheners and matrix comprising:

a) sealingly positioning a deformable member in between a strengthener chamber of a first mold portion and a compression chamber of a second mold portion; said strengthener chamber including the

strengthener;

b) repeating said sealingly positioning a deformable member by stacking a number of subsequent mold portions one next to the other determined by a predetermined number of parts to manufacture;

c) impregnating the strengtheners with matrix injected in said strengthener chambers;

d) compacting the matrix toward the strengthener by pressurizing a controlling fluid injected in said compression chamber on said deformable member.

63. A method as recited in claim 62, wherein said impregnating the strengtheners with matrix injected in said strengthener chambers is performed with a delay between each sequential injection of matrix in consecutive strengtheners.

64. A method as recited in claim 62, further including a cure of the strengtheners performed by heating said first mold portion; whereby said second mold portions and said subsequent mold portions are sequentially heated by heat transfer from a previously heated mold portion.

65. A method for generating a predetermined number of composite parts from strengtheners and matrix comprising:

a) positioning an alternating stack of strengtheners and deformable members in a stacking chamber generated by sealingly mounting frame assemblies on a base mold assembly;

b) impregnating the strengtheners with matrix injected in said stacking chamber;

c) compacting the matrix toward and along the strengtheners by pressurizing on said stack of strengtheners and deformable members.

66. A method as recited in claim 65, wherein said impregnating the strengtheners with matrix is performed while successively injecting the matrix into consecutive strengtheners with a slight delay between each injection.

67. A method as recited in claim 66, wherein said compacting the matrix is performed while said successively injecting the matrix, said successively injecting the matrix including at least a first injection in a first strengthener and a second injection in a second strengthener with a delay from said first injection; said second injection compressing said first strengthener by pressurizing said deformable member provided in between said first and second strengthener.

68. A method as recited in claim 65, wherein said positioning an alternating stack of strengtheners and deformable members further provides for a membrane provided in between the strengtheners and the deformable members.

69. A method as recited in claim 68, wherein said compacting the matrix toward and along the strengthener is performed while pressurizing a controlling fluid injected in said stacking chamber on said membrane.